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References

A plethora of references when applying for a fresh post is not invariably a commendation. Similarly, a long list of references as an appendix to a technical paper is no real guide as to its worth. Indeed, it may indicate that the author is well read, and that he has used his erudition as "padding" to cover up his paucity of original work. One wonders why technical papers should be embellished with so many references. If the author imagines they enter the same category as Patent specifications in which it is not unusual to cite as disclaimers earlier specifications, then he, too, can acknowledge, in a general way, that he has drawn on published information. If he wishes to give a modicum of publicity to others working in the same field, then good luck to him, for technicians in the ordinary way get too little of the limelight. In any case, but a minimum of people, except perhaps students or research workers, ever bother to turn up the references quoted. For one thing, readers seldom have access to the necessary original publications.

Before the war, we used to have German translated by an erudite member of a firm of Patent agents and after taking the trouble of checking up the accuracy of references cited, he usually reported about 10 per cent. of errors. Thus the value of these lists of references may not be as great as their length would indicate. It is to be noted that when an eminent scientist gives a lecture, the references to other workers are kept to a minimum; there are, however, some exceptions, and for one we have in mind over one hundred were included. With all due deference to the brilliant author, we suggest that it served no really useful purpose.

The habit of including a quantity of references is growing and an excessive number undoubtedly detracts from reader interest. A book we recently read on the Elizabethan period written by a university don contained an apology for the inclusion of so many references, as ease of reading was impaired by the inclusion of asterisks and obelisks or, more modernly, little numbers, and it is but a courtesy to the reader to keep them to a minimum. We realize that they are essential in some cases, but their major import is enhanced when they are used with discretion. These remarks are addressed mainly to the younger generation who are following current fashions to the general detriment of good quality in the presentation of their work. In the printed word, readability is of the utmost importance and we ask lecturers to imagine what would be the effect if, when delivering their paper, they interlarded it with references! Yet exactly the same features obtrude when reading their theses.

B

British Non-ferrous Metals Research Association

Annual Meeting, April 22

In connection with the annual meeting and luncheon of the British Non-Ferrous Metals Research Association at which Lord Woolton (Lord President of the Council) was the chief speaker, at the Savoy Hotel last Tuesday, an exhibition was held demonstrating the results of some of the Association's more recent researches.

From the Annual Report we cull the following items as being of interest to the foundry industry:—

Mr. W. A. Baker, research manager, visited the United States during the autumn under the auspices of the Organization for European Economic Co-operation. He travelled with a party of European metallurgists visiting American non-ferrous metal plants and attended the World Metallurgical Congress in Detroit.

Membership

The total membership of the Association at the end of 1951 was 550, an increase of 55 over the previous year. This is due in the main to the accession to membership of the constituent firms of the Hot Dip Galvanizers' Association, and the formation of a research group of the Association of Bronze and Brass Founders, the members of which group agreed to become members of the Association. In view of the necessity for a substantial increase in income in the immediate future the finance committee is again considering ways of interesting others firms in the Association's work. All members will help considerably if they will bring the advantages of membership of the Association to the notice of their industrial friends who they think might be interested.

Melting and Casting

In the review of the progress during 1951 are included the co-operative trials of refractory linings for melting copper and copper-rich alloys in Ajax-Wyatt low-frequency furnaces which are continuing in members' works and, in several cases, are giving promising results. One of the major factors determining the life of the refractory is its resistance to attack by oxides and other slags, and this characteristic has already been shown to depend not only on the composition of the refractory but to a marked extent on the manner in which it is rammed. Further work to throw light on the influence of composition and ramming conditions is continuing in the Association's laboratory side by side with the works' trials.

It has now been shown that the grain size of cast copper-base alloys can be refined by adding small amounts of elements which produce in the liquid alloy a dispersion of solid particles on which the copper-rich solid solutions readily crystallize with little undercooling. This mechanism of grain-refinement is identical with that established earlier for aluminium-base alloys. The position has now been reached where laboratory experiments are in hand to see whether grain-refinement of cast copper-base alloys improves their casting behaviour in the same ways as it does the casting properties of light alloys. If this proves to be the case, and if the grain-refining technique can be applied without undue difficulty on a large scale, the results of this work should produce marked improvements in the quality of copper-alloy castings, and lead ultimately to economies in consumption of metal.

In accordance with the research board's policy to undertake work which will facilitate the application of existing knowledge in practice, new work was started in the year under review to help members apply in their

(*Continued at the foot of Col. 2*)

foundries the best methods of producing copper-base alloy sand castings. Work has been undertaken both in the laboratory and in the foundries of member firms, the latter with particular reference to the development of simple techniques for degassing molten copper-base alloys and for measurement of casting temperatures, and the former involving an experimental study of the optimum size, shape and disposition of feeder heads for sand castings. Much information is available on this latter point, but its application in practice usually involves some development work, and the purpose of the laboratory work now in hand is to arrive at some empirical relationships which will help in the application of this information in those foundries which do not possess the facilities for carrying out development work of this kind. It is hoped that, with the information obtained, it will be possible to recommend the precise size, shape and disposition of feeder heads for castings of a given section and other critical dimensions, and if this hope is realized the information obtained should be of real and practical value to members.

Long-service Presentation Dinner

More than 100 out of the 700 employees of the Wolverhampton Metal Company, Limited (incorporating the James Bridge Copper Works, Limited), non-ferrous metal refiners and ingot manufacturers, last Thursday received long-service awards at a dinner given by the Company in their honour at Wulfruna Hall, Wolverhampton. Addressing the assembled employees and guests numbering about 200, Mr. T. C. James, chairman and managing director, himself with 53 years' service the doyen of the recipients, outlined the history of the group from its inception by his grandfather about 70 yrs. ago. Much of the firm's present high standing was due, he said, to pioneer work by his five brothers, his co-directors, and the loyalty of those about to receive awards.

Later, Mr. James referred to the establishment in 1946 of a trust fund for the benefit of workpeople and members of their families who through illness or hardship were in financial need. In 1956, this fund is to be liquidated, and the balance divided amongst those then employed, who were on the payroll in 1946. In continuation of the scheme, however, a new fund was being built up to continue the present benefits after the first is wound up.

In the actual presentation ceremony, canteens of cutlery, clocks, watches and plate were distributed amongst 63 employees with from 25 to 30 yrs. service, 40 with 31 to 40 yrs., and one, Mr. T. Turner, with between 41 and 50 yrs. Additionally, Mr. J. H. Furnival (46 yrs.), Mr. A. M. Anderson (31 yrs.), and Mr. R. Wood (27 yrs.) were other directors who received awards. Mutual admiration was evidenced by the handing of gifts to Mr. Jones and Mr. Furnival from the long-service employees themselves. The first of its kind, it was an entirely happy function, indicative of the advantages of working for a "good" firm. Other presentations are expected to be made annually.

THE JUNIOR INSTITUTION OF ENGINEERS offers for annual competition the Durham Bursary of the value of £20 in cash. The award carries with it membership of the institution for three years. Candidates must be over 19 and under 25 years of age at the time of entry, but they need not already be members of the institution. Entry forms and the full conditions of the bursary may be obtained from the secretary, the Junior Institution of Engineers, 39, Victoria Street, Westminster, London, S.W.1.

Requirements of Machine-shop Inspection*

By C. Walker and F. H. Greenwood

The first part of the Paper which follows was presented by Mr. Greenwood and mainly concerns the machinist's viewpoint of the quality of castings, from the design, jigging, accuracy, machinability and inspection angles, including a note on the dislocation caused to production machining schedules by faulty castings. The second section, given by Mr. Walker, consists of examples of inspection methods in use at Vauxhall Motors' works and illustrations of jigs, fixtures and records which are kept.

Design

The design of a casting should be such that it can be produced in such a form as will give the designer what he requires and create no production problems in either foundry, machine-shop, or during assembly, and this to be accomplished in an economical manner. During the intermediate design stages, the foundry should be consulted as to the influence of the design on existing or projected foundry practice.

It should be borne in mind at all times that a component is being designed, primarily to fulfil a definite function, not entirely for the benefit of the foundry. Where a compromise is necessary, the cost must be appreciated. Cost may be in terms of money or service. If a component fails in service, one should not find it necessary to tell the customer that this is the result of a faulty combination of interests, or that for fourpence more spent in production the component would not have failed.

Given the fact that the component must function efficiently, one primary fact still remains: that is, that the price of the component in its finished state as sold to the customer is what counts, not necessarily the price at an intermediate stage.

Machining and Jigging

Dimensions and Tolerances.—After the designer and the foundry have adjusted their differences, the planning department comes into the picture and decides upon machining allowances, location points, clearances, and any points which affect the jigging. This stage should be the opportune moment to review any snags which may arise during machining, such as the probability of local chilling on corners or thin sections, porosity in bosses adjoining thin sections, swells or distortion on machined faces, draft angles, and their influence on machining.

On faces of any depth, taper is an important item, a difference of 1 deg. means 0.0175 in. per in. of depth; thus a reduction of draft means more latitude in dimensions relative to the location points for the same maximum machining allowance. In order more fully to illustrate this point, Fig. 1 has been prepared showing the influence of draft angle on faces of various depths. This is an item of great importance in the machine-shop. It should be borne in mind that machining allowances are imposed by the limitations of the foundry as regards dimensional accuracy. A higher standard of accuracy in the foundry should result in economies in further processing.

Here it should be emphasized that it is the larger and more complicated castings such as cylinder-blocks, cylinder-heads, axle casings, hubs and brake-drums, etc., which are high production jobs in the motor industry, that the Author has in mind at the moment. Accuracy in the foundry product means reduction in processing costs, reduction in ultimate cost, higher and more economical performance of the finished vehicle. As regards grey-iron castings, there is, to the writer's knowledge, at least one foundry at which executives think and plan in terms of accuracy and economy. Their inspection department makes great use of clock indicators graduated in thousandths of an inch in checking castings relative to the machine locations. One fixture alone embodies six indicators for setting the casting in position relative to the location pads. As a direct result of this outlook, machining allowances are discussed in terms of 0.005-in. steps. On a casting of approximately 27½ by 7½ by 3¾ in. and weighing 82 lb. before machining, there is a machining allowance on the top and bottom faces of $\frac{5}{64}$ in., or 0.078 in.

On the particular casting, out of a weight as delivered of 82 lb., there is removed 11¼ lb., or 16.7 per cent. of the finished weight of 70¼ lb. From another source, the weight as delivered was 87 lb., or a difference of 5 lb. This difference of 5 lb. between two castings takes some explaining, as also does the fact that the finished weight is 73¼ lb., or a difference of 3 lb. The only explanation which occurs to the Author is that the standard inch varies according to the geographical position of the foundry! On another casting approximately 30 by 10½ by 10¼ in., weighing as delivered 198½ lb., there was removed in machining 39 lb. or 26 per cent. of the finished weight of 149½ lb. It must be terrible for a

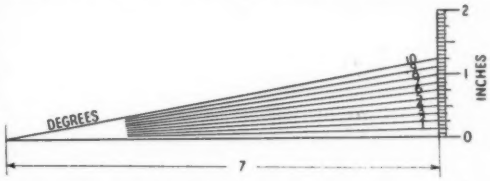


FIG. 1.—*Influence of Pattern Draft on Dimensions of Faces at Various Depths.*

* Paper read before the East Midland branch of the Institute of British Foundrymen, Mr. C. A. Payne presiding. The Authors are on the staff of Vauxhall Motors, Limited.

TABLE I.—*Comparison of Castings of the Same Part Number, from Two Different sources. Approx. Dimensions, 27½ by 7½ by 3⅜ in. and (below), One Casting, Approx. Dimensions 30 by 10½ by 10¾ in.*

—	Castings. A.	Castings. B.	Difference.
Machining allowance, bottom face ..	⅜ in.	1/16 in.	5/16 in.
,, ,, top face ..	7/16 in.	1/16 in.	3/16 in.
Weight before maching, in pounds ..	87	82	5
,, after machining, in pounds ..	73½	70½	3
Excess on finished weight, in pounds ..	14½	11½	2½
,, ,, ,, as percentage	19½	16.7	

Difference in finished weight .. .. 8 lb.

Machining allowance top and bottom faces	½ in.
Weight before machining, in pounds	198½
,, after machining, in pounds	149½
Excess on finished weight, in pounds	39
,, ,, ,, as percentage	26

TABLE II.—*Weights of Castings (in Pounds) Before and After Machining.*

Casting.	Rough weight.	Finished weight.	Excess on finished weight.	Per cent.
A	11½	7¼	4¼	58
B	28	21½	6½	32
C	4½	2¾	1¾	64
D	6¾	5½	1¼	29
E	20	15¼	4¾	31
F	102	83	19	23
Total ..	172¾	134¾	38	(av.) 28.4

foundryman to see a load of castings leave for delivery and realise that over 25 per cent. is going to be removed to correct for dimensional inaccuracies. Machinists are not much better off on smaller castings, as in a selection of smaller castings, the finished weight of which varied between 2¼ lb. and 83 lb., the percentage removed during machining varied between 23 and 64 per cent. Six finished castings weighed 134¾ lb. and as delivered 172¾ lb., thus 38 lb. was removed or 28.4 per cent. of the finished weight. So that foundrymen may thoroughly appreciate these facts, Table II has been prepared showing the details. Generally speaking, with one exception they may be termed "machined all-over," this not including the boring of the large holes from the solid.

Easy Machinability

It is known that in certain instances grey-iron castings are made in permanent moulds, but here again there are limitations, the shape of the casting has to be suitable and there are also the limitations imposed by the composition of the metal. There is ample room here for the metallurgist to develop suitable alloys for a further range of castings.

The introduction of permanent moulds is a definite progressive step, but in the U.S.A., carburettor float chambers were, it is thought, made by this progress twenty years ago, so there should be some experience here on which to develop. The metallurgist has progessed in giving more durable materials, but there is still plenty of scope in giving users the required physical properties and uniform free-machining qualities with real emphasis on the latter.

Absence of free machining-qualities, means for a given output, more machines and space, also higher tool and power costs. In emphasizing easy machining so much, it is as well to realize that machine-tools and cutting tools have progressed rapidly, but the foundry still manage to supply some castings which have the better of the argument; in fact sometimes customers think that cutting tools cast in the same material as the job would do better. Fig. 2 shows a few examples of such

FIG. 2.—*Group of Castings on which Areas Difficult to Machine are Encountered.*

castings. It should be appreciated that improved control of machining qualities will ultimately be of great benefit to both the foundry sales department and the customer.

Inspection of Castings

The foundry having produced a casting in a material which the "back-room boys" of the laboratory say is entirely suitable for the service required, it is now time to see if the result of their joint effort fills the bill as regards customer requirements. The foundry inspection department, having been satisfied that the *drawing* does not need too many modifications to agree with the casting, it is sent to the customer as a sample for approval. The usual practice is for the sample to be handed over at inspection headquarters for "marking off," using the machine locations as data; as the drawings of, say, a cylinder-block may have something like four hundred dimensions this usually takes some time.

A report having been prepared, it is then submitted to the planning and tool departments for comments as regards machining allowances, jig clearances, etc. If a second sample be available this is machined as far as equipment is available and then sectioned for further checking. At this stage, an approach to the customer comes into the picture, when the foundry representative discusses various points with the departments concerned. Ultimately the sample receives limited approval or approval for bulk supplies. Castings which are in bulk supply should, before leaving the foundry, be inspected on jigs or fixtures that possess locations which are replicas of those used in the machine-shop, and should show the position of any cored holes that are to be jig bored; machining allowances should be checked, preferably with "go" and "not go" gauges. (Fig. 3.)

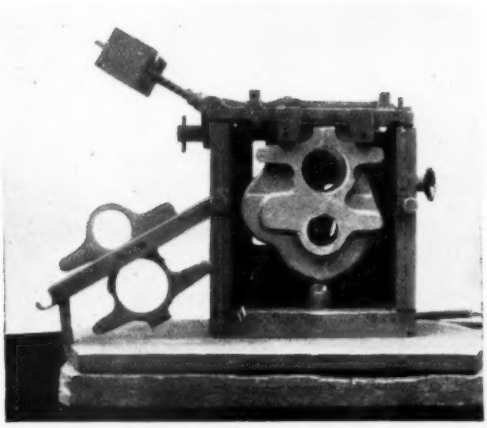


FIG. 3.—*Checking of the Dimensional Accuracy of a Casting on a Jig which embodies "Go" and "Not Go" Gauges.*

Any points where chilled areas are likely to develop or are shown up by consultation with the customer should be file tested. Where castings are machined on a production line, a chilled area can cause a serious break in production, as the stopping of a machine may cause all the succeeding operations to cease; delays cost money and add to the cost of production, whereas the aim should be to give a better job at a lower cost. On major castings, it is a great advantage in checking up on rejects, for the castings to be dated, showing day, month, and year, also where modifications to design are made; the number of the modification should be shown adjacent to the customer's part number. Where

FIG. 4.—*Interior View of the Vauxhall Inspection Headquarters.*

FIG. 5.—*Examples of Fixtures used in the Factory for Checking Induction- and Exhaust-manifold Castings.*

modifications are made to the foundry production procedure, an identification symbol should also be made.

This all seems very complicated, but years of experience in the machining of castings have shown that it is a worthwhile provision when investigating rejects, and foundrymen can be assured that sometimes defective castings do cause trouble in the machine-shop. Having reached the stage where the customer may have some trouble, this is the time to enlarge on a previously mentioned term, "consultation with the customer."

Consultation with the Customer

Where castings are in daily production, it is essential to follow-up the results in the machine-shop and the laboratory by visits at mutually agreeable intervals, when the weekly reports of defective castings can be followed up. The visit should be made by the chief inspector or some person acting on his behalf, and copies of his report should be circulated to the heads of all departments concerned. Castings, on receipt at the machinists, before being issued to production areas, are routed through the receiving inspection department, where samples are checked on checking fixtures; while this is proceeding a Brinell report is being prepared and drillings or a sample are submitted to the laboratory for approval.

There are some defects which are only visible during machining, and when these are inspected "foundrywise" at the source, it ensures a correct interpretation of the defect reaching the foundry, if necessary, by telephone during the visit.

Where there are occasional dimensional discrepancies, one method is to "stick a bit on." If this be done, it may make the defectives better, but it will also have the effect of causing excess machining allowances on castings which would otherwise be correct. The objective should be the determination of the cause of the defect and not the exercise of prodigality with metal, for metal costs money and the customer pays, ultimately. In other words, having been presented with the effect—eliminate the cause. At this stage it may be as well to ponder on how much of a ladleful of metal reaches the ultimate purchaser. All the metal which is removed, at whatever stage, is an index of the efficiency of a process.

Re-working Defective Castings

It may be opportune to mention a frequent cause of delay in the machine or assembly divisions; that is the re-working of defective castings. It must be appreciated that production is planned ahead—that is, every single operation is tabulated and equipment decided upon, ordered, and ultimately delivered. Machining allowances are decided upon in conjunction with the foundry representative. If, when the casting comes into production, the foundry decide that they want a "bit more" in a certain position owing to their being unable to maintain the characteristics of the sample, the existing equipment may not be able to take care of this "bit more," and it may be necessary to replan and insert an extra machine operation to cope with the "bit more." The extra machine has to be fitted-in somehow and afterthoughts are not always as efficient as the original planning. Where, in order for the casting to be processed as planned, it may be necessary to "re-work" castings in order to keep the line moving or to maintain output. This creates another problem: "Who is going to pay?"

One way of looking at this problem is this: The customer approves of a sample and expects bulk supplies to maintain this standard and plans and costs the job on this basis. If the casting is not to this standard and the error costs time and money to correct, then this charge is passed back to the foundry, who either absorb it or carry it forward and ultimately pass it back to the customer in the form of a percentage extra on their price. Neither the foundry nor the customer like this state of affairs, so the foundry inspection staff usually take the necessary action to eliminate the trouble at the source.

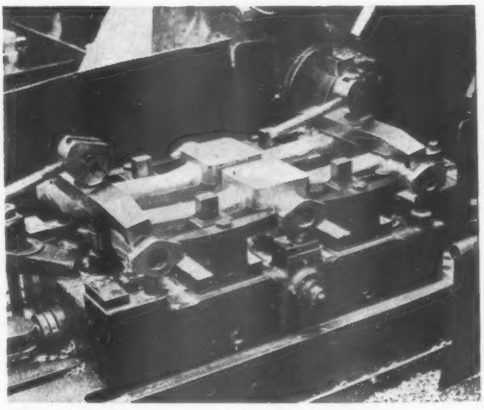


FIG. 6.—*Set-up for Machining Induction-manifold Castings in Pairs.*

Viewing the whole problem broadly, it may be stated that if the metallurgist could supply more suitable materials from which the foundry could produce the maximum quantity of accurate castings per ladle of metal, which could be economically processed in the machine-shops to the required accuracy, the designer could then give us more efficient, lighter, and more economical vehicles. This, then, is a mutual problem and, when the millennium is reached, the road will probably be so stiff with motor vehicles that no-one will be unable to use them. This, however, will be some other people's worry, so let both sides face up to their mutual problem. In concluding his section, the Author would add in all sincerity: Get customer-minded, keep customer-minded, and avoid the customer having doubts about the products he is buying and using.

In closing this section the Author thanked Vauxhall Motors, Limited, for facilities enabling him to compile this Paper. He was grateful to Mr. M. C. Park, chief inspector of the firm, for his helpful advice, and to his colleague Mr. C. W. Walker for his co-operation and forbearance.

Inspection Headquarters

At this point in the proceedings, Mr. Walker took over and showed a number of slides.

The first, Fig. 4, showed a view of the Vauxhall inspection headquarters, where sample castings are received and approved before sanction is given to the suppliers to proceed with bulk supplies. The castings are checked, chiefly by precision methods of measurement. After the casting has been marked out and checked as far as possible without sectioning, to ensure that it is dimensionally acceptable, it is then submitted to the production engineering department, where sometimes requests are made for slight corrections or improvements to location positions to make easier and more positive the loading of the castings into the various machining jigs. The casting is then returned to inspection headquarters, where it is sectioned to see if the wall-thickness and core positions are satisfactory and also to ensure there are no hidden defects. A section is then passed on to the laboratory for a report and

FIG. 7.—*Casting-checking Fixture for a Gear-casing and Clutch-housing Casting.*

FIG. 8.—*Cylinder-block Casting being Water-tested for Leaks in the Jacket. All Block Castings undergo this Check.*

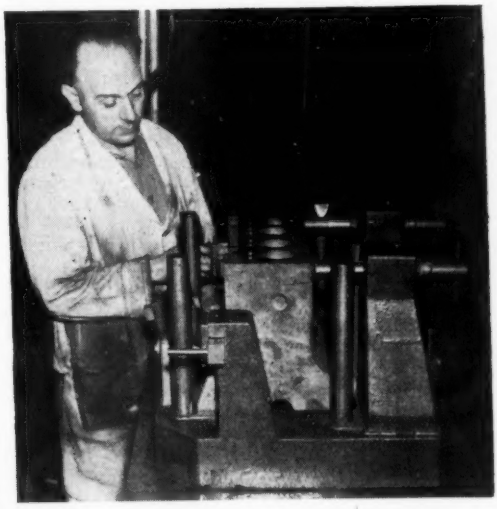


FIG. 9.—*Inspector checking the Relationship of Two Location Holes drilled in the Sump Face of a Cylinder-block. Many of the Dimensions can be checked from this Set-up.*

TABLE III.—*Specimen of a Material Specification Sheet for Castings.*

Part Name *Flywheel*	Date 10/7/46 Part No. 7070929-8

General Material Classification (1) *Chromium cast iron.*
(2) *"Meehanite" cast iron.*

Chemical analysis (per cent.).		Physical properties.	
		Rough (as purchased).	Finished component.
(1) *Total carbon* .. .. .. 3.15–3.50 *Combined carbon* .. .. 0.40–0.65 *Manganese* .. .. .. 0.40–0.60 *Sulphur* .. .. .. 0.10 max. *Phosphorus* .. .. .. 0.30 max. *Chromium* .. .. .. 0.25–0.40 *Silicon approx.* .. .. .. 1.70 *or to give specified physical properties*	(2) *"Meehanite"* *Grade "D"*	*Brinell Hardness Nos.* 197–229. *Tensile strength of iron within* $\frac{1}{2}$ *in. of rim surface of casting* 12.0 *tons sq. in. min.*	

HEAT TREATMENT.

ROUGH (condition when purchased)	FINISHED (Works operations)

CHANGE RECORD.

Date.	Mark.	Order No.	Change Details.

GENERAL SPECIFICATION AND INSTRUCTIONS *Castings shall be sound and clean and free from porosity, shrinkage, gas cavities, sand, chilled edges or areas, or other defects detrimental to serviceability or machinability. They shall be of smooth clean surface.*

APPROVED—Metallurgical Dept. *H. B. Bavister.* Engineering Dept. *A. Larking.*

providing the inspection, production engineering and the laboratory are satisfied, the supplier and the material-control department are notified and the supplier is then requested to proceed with bulk supplies as scheduled. An exception to this method is when there are major samples for approval, then a small sample batch are usually sent along so that these can be tried out and all machining operations completed before giving a final acceptance. Sample proving cards are kept on which a complete recording is made of all details and dates of how the sample is progressing up to the final date of acceptance.

When proving samples for a new model, a graphical record is kept to see what progress is being made to meet the target date. A reference to the chart shows the quantity of parts released by the engineering department, also the number and percentage of parts proved and the date of approval. It also indicates clearly the progress made week by week, and where the progress is slow then immediate action can be taken. Usually a meeting is held to enquire into the reasons for delay so that those concerned can urge the outstanding items along.

Material Specification

Table III shows a sample of a material specification sheet, and on it is recorded the part name, its number, chemical analysis, physical properties, general specifications and instructions. These sheets which are issued by the laboratory are made out not only for castings but for practically all parts and components used in the factory. A number of fixtures are used in the factory for checking castings as received and Fig. 5 shows a few used for checking induction and exhaust manifolds. These are checked for definite location positions, machining allowances and positions of the cores and flanges. To illustrate the importance of location positions, Fig. 6 follows up Fig. 5 by showing induction manifolds being milled on the feet in pairs; once the correct setting is made, no further alteration to the machine setting should be required.

The illustration, Fig. 7, shows a casting checking fixture for a passenger-type gear-casing and clutch-housing. The casting can be checked for all machining allowances, and here again one cannot overemphasize the importance of the location points, which, on this casting, are radially at three positions on the periphery of the clutch-housing. These must be in correct relationship with a cone (cast only for machining purposes) which is at the rear of the core for the mainshaft bore. Although castings are inspected in the receiving inspection department there are, of course, defects which are only revealed during machining. In order that a true record can

be made of these rejections in the various machining areas a " rejection against supplier " record sheet is compiled. The part name and number is recorded against the quantity machined, also the number and percentage rejected, and further along the defects are detailed recording the various rejection faults, *viz.*, " blown," " hard," " distorted," " scant machining allowance," etc.

Cylinder-block Checking

Fig. 8 shows a cylinder-block being water-pressure tested for leaks. This test is carried out 100 per cent. on the production lines after the block has been partly machined, and the test is carried out at 60 lb. sq. in. pressure. Quite a lot of attention is paid to " stage " or intermediate checking during the process of machining castings and in fact all material which is manufactured, as, of course, the cheapest and most desirable place to find inaccuracies is at the operation where the error is first revealed. The next illustration (Fig. 9) shows an inspector checking the relationship of two location holes which are drilled in the sump face of a cylinder-block, which should be correctly positioned with the initial locations provided by the foundry. The casting is located for the first machining operation on three location pads, two of which can be seen just below the cylinder-head face, and one which is not visible on the slide, but is placed just above the sump face on a line midway between the other two locations. The casting is located in the other plane by two pads on the top of the sump face. The vertical bars are simply to assist loading. The retracting bars are for measuring the correct position of the location pads, the error being measured between the flange on the bar and the boss on the fixture, when the inner end of the bar is in contact with the location pads. Other checks for machining operations are also made, such as the push-rod cover face, distributor boss, fuel-pump flange; in fact this fixture gives a complete check up to the actual position on the machining production line. Throughout the factory, items are taken out of the production stream weekly to ensure that satisfactory standards are being maintained.

In a number of the production areas, quality-control charts have been introduced. On the chart is recorded, weekly, the number passed and the number rejected and the various suppliers have different colour-code markings. A quick reference can be made to the chart to see how many rejections are being made each week, and from the data recorded action taken to overcome previous heavy rejection of these items can be ascertained. A supplier's representative is notified when the works is in trouble and he usually finds the answer by quickly supplying sound castings to keep the production lines going. Without exaggeration, it should be clear that a well-organized control of quality is required both in the foundry and in the further stages of manufacture, as the most undesirable place for a faulty part to be found, whatever it may be, is when it is in the customer's possession.

Corrosion Resistance of Aluminium

Mr. J. Venus, in a Paper on " Marine Developments in Aluminium," which he gave to the Institution of Engineers and Shipbuilders in Scotland, includes a table, reproduced below, giving data of aluminium alloys suitable for shipbuilding purposes.

B.S.1490.	Nominal composition (principal constituents only).	Specified minimum mechanical properties.		Notes.
		Ultimate tensile strength, tons per sq. in.	Elongation on 2 in. per cent.	
	Per cent.			
LM 5-M..	3.0–6.0 Mg 0.3–0.7 Mn	(S) 9 (C) 11	3 5	High corrosion resistance. Not suitable for intricate shapes and thin sections.
LM 6-M..	10–13 Si	(S) 10.5 (C) 12.0	5 7	Good corrosion resistance. Suitable for intricate shapes, thin sections, and pressure-tight castings.
LM 10-W	9.5–11 Mg	(S) 18 (C) 20	8 12	Good corrosion resistance. Suitable for simple castings where high strength and ductility are required.

S = sand cast. C = chill cast.

Included only as indication of type of alloy; for fuller information see B.S. 1490. A.D.A. Information Bulletin No. 17, " Aluminium Alloy Castings," gives further details of casting alloys, their characteristics and uses.

House Organ

Bulletin of the British Cast Iron Research Association, Vol. II, No. 5. Published by the Association from Alvechurch, Birmingham.

From the news items appearing in this issue we learn that Dr. Pearce has been appointed vice-chairman of the National Foundry College after serving since its inception as honorary technical adviser and treasurer. The following staff changes are set out:—Mr. W. J. Driscoll, Mr. D. Marles and Mr. S. W. Palmer have left the Association to take up industrial appointments. Mr. J. Grant has been transferred from " research " to " development," and Mr. F. Dunn from " development " to " operational research team." This team has been strengthened by the appointment of Mr. E. A. Skinner and Mr. H. S. Boyle. The former was formerly assistant foundry manager at Guest Keen & Nettlefolds (Cwmbran), Limited, after experience at the Ford Motor Company, Limited, and the latter comes from the foundry planning department of the Austin Motor Company, Limited. A further recruit is Mr. G. Harrison, who joins the development staff. He has the diploma of the National Foundry College, and was awarded a Fellowship of the Worshipful Company of Founders. This issue carries in abstract form the Factory Report, lists the additions to the library, and prints the usual abstracts from foundry literature.

FOREIGN FIRMS are invited to exhibit goods at the 1952 Iron and Steel Exposition, to be held in conjunction with the annual convention of the Association of Iron and Steel Engineers in the Cleveland Public Auditorium from September 30 to October 3, inclusive.

F

French Foundry Congress

25th Annual Function, Lille, May 19 to 21

The XXVth Annual Congress of the *Association Technique de Fonderie* will be held at the Maison du Commerce, 77, rue Nationale, Lille. The following programme has been envisaged:—

Monday, May 19.—11 a.m., opening speeches, followed by a Paper on the "Use of Extensometers and Strain Gauges in Steel Works," by Mr. E. Sautereau. Luncheon to be served at 12.30.

Resuming at 2.30 p.m. there are to be presented the following Papers:—"Correlation between Different Mechanical Tests given by Grey Iron," by Mr. E. Doat and Mr. F. Danis; "Classic Mechanical Tests—Incidence of Methods of Operation on Correlation of Results," by Mr. L. Soustre and Mr. P. Broquet; "On the Service Fracture of Castings subjected to Cyclic Stresses," by Mr. H. de Leiris; "Some Considerations on the Measurement of Moduli of Elasticity of Cast Iron," by Professor Le Rolland and Madam Plenard; "Some Notes on Atmospheric Risers," by Mr. Jean Gelain, and "Porosity, Solidification Period and Phosphide Eutectic," by Mr. J. Leonard.

Tuesday, May 20.—An early start, 8.30 a.m., is to be made for the presentation of the following Papers:—"Life of Clay in Moulding Sands," by Mr. Pierre Nicholas; "Foundry Bonds," by Mr. Meyer; "Progress with Synthetic-resin Core-binders," by Mr. P. G. Pentz and Mr. G. L. Harbach (British Exchange Paper); "A Contribution to the Microscopical Examination of Core-binders," by Franz Roll (German Official Exchange Paper); "Portable Drying Stoves," by Mr. Georges Ulmer and Mr. M. Decrop. At 12.30 luncheon will be served, and at 2.30 members will visit the works of the Five-Lille Company.

Wednesday, May 21.—Again the start is at 8.30, when the following Papers will be presented:—"Quench Burns in Light Alloy Castings during Thermal Treatment," by Mr. Henry Garnier; "Study of a Light Alloy Casting submitted to Static and Dynamic Stresses," by Mr. L. Grand; "Elimination of Aluminium in Tin Bronzes," by Mr. Georges Blanc and Mr. P. J. Le Thomas; "Study of the Teeming Speed on Copper Alloys," by Mr. M. Cirou; "Note on the Making of Precision Pattern-plates," by Mr. Bernard Faure (with the showing of a colour film). The closing speeches are scheduled for 11.50. After luncheon at 12.30, there is to be a visit to the Cokeries d'Hénin et de Drocourt.

C.F.A. Tenth Annual Meeting

At the tenth annual meeting of the Council of Ironfoundry Associations held in London recently, Mr. N. P. Newman was again re-elected chairman and was heartily thanked for the work which he had carried out during 1951. The three vice-chairmen were re-elected. The executive and finance committee is at present composed as follows:—*Chairman*, Mr. N. P. Newman; *vice-chairmen*: Mr. J. D. Carmichael; Mr. F. D. Ley; and Mr. H. V. Shelton; *elected members*: Mr. D. G. Bisset; Mr. P. L. Gould; Mr. V. Jobson; Mr. A. E. Pearce; Mr. S. H. Russell; and Mr. A. Watson; *nominated members*: Mr. J. W. Gardom (I.B.F.) and Dr. J. E. Hurst (B.C.I.R.A.).

I.B.F. Golf Tournament

As previously noted, this is to be held at Woodhall Spa on September 27 and 28. Details of the various competitions have now been printed and are available from Mr. F. Arnold Wilson, c/o William Jacks & Company, Limited, Winchester House, Old Broad Street, London, E.C.2.

Leaders of the Industry

MR. GEORGE GUMMER

The 1952 president of the National Brassfoundry Association is Mr. George Gummer, chairman and managing director of Gummers, Limited, of Rotherham, who manufacture bronze, iron and steel valves for water and steam. This is a characteristic family firm, Mr. Gummer representing the third generation, and a fourth has already entered the business. The Company was founded 75 yrs. ago, and the present year is Mr. George Gummer's fiftieth in the industry. He is the second Yorkshire president, Mr. Albert Ellis, of Peglers, Limited, Doncaster, having served the Association in that capacity in 1946.

Mr. Gummer's grandfather, Alderman W. H. Gummer, was twice Mayor of Rotherham, and his father, Alderman George Gummer, J.P., was Mayor three times. Mr. Gummer has not felt a similar desire for service in local government, but is a Greave of the Feofees of the Common Lands of Rotherham. This is an ancient Trust, with a Deed dating back to 1589. Until last year, Mr. Gummer was president of the Northern Employers' Brassfounders' Association, which, in 1943, became the Yorkshire branch of the National Brassfoundry Association. He has twice held this office, and succeeded his father in it in 1932. Alderman George Gummer was the founder of that Association in 1898, and was chairman of it until his retirement.

Trade Balance Improves

According to figures issued by the Board of Trade, the provisional total value of United Kingdom exports in March was £245,500,000. This was a further improvement in the rate of export compared with January and February. United Kingdom exports in the first quarter were 12 per cent. more than the average for 1951. Re-exports in March were valued at £20,200,000. Imports last month were valued at £332,800,000.

The three months' adverse balance of £212,800,000 was well below the quarterly average for 1951 of £301,900,000.

National Brassfoundry Association

Annual Report

At the annual meeting of the National Brassfoundry Association held on April 22, the Annual Report of the National Executive Council was presented, extracts from which are printed below.

At this time last year the report of the Association's Council was presented in circumstances of the gravest anxiety. The prohibition of manufacture of a wide range of the members' products caused much consternation and endangered the continuing existence of several firms. Although this danger has not been entirely removed, the Association has, as a result of continued pressure and reasoned representations, obtained considerable modifications, which have to some extent eased the burdens of the members. In addition, as a result of discussions with the Ministries concerned, a generous interpretation has been obtained of the circumstances under which exemptions from the Orders have been granted by the issue of licences. Amending Orders have been issued during the year, unfortunately without consultation with the affected industries, and, as a result, they too have had to be amended. The Association has submitted its views on the appropriate wording to be adopted, and the Board of Trade and the Ministry of Works, in particular, have been ready to place the highest value on the advice and opinions expressed. A small deputation has also met Sir Eric Bowyer, deputy secretary of the Ministry of Supply, further to submit the plight in which these Orders could plunge many firms engaged in the industry, and to plead for special treatment in respect of rearmament contracts. In this latter connection, the nature of the firms engaged in this industry is such that their interest is mostly in the more remote processes of sub-contracting and consequently the Ministry was not able to offer a great deal of assistance.

So far, largely thanks to the concessions which the Association's representations have obtained, no firm has had actually to close down, but dismissals of workpeople have already commenced, and it is feared that some special skills may be lost to the trade. This is particularly applicable to the cases of elderly workers, for whom no vacancies readily exist; in any case, it is felt that it is not merely a case of finding employment for displaced labour, so much as to find them work in which their special skills can be fully utilized and in which, in consequence, they can also be happily employed. In the brassfoundry industry, with its outstanding record of happy labour relations, the Association has never regarded workpeople as statistics or as part of the fixtures, but as humans entitled to a maximum of consideration.

Membership.—The Association had, at December 31, 232 members, a small reduction on the previous year. All resignations have been due to the activities of the firms concerned ceasing in relation to the services of the Association.

Accounts.—The income and expenditure account and balance sheet show by far the best balance that the Association has enjoyed for several years. This can partly be attributed to the small increase in the rate of subscriptions and partly to the economical manner in which the Association's affairs have been handled in the face of rising costs. This increased income is, however, necessary, as a safeguard against further increases in the cost of goods and supplies and also, because of the possibility of the rent or amortization of any new premises that the Association may acquire, exceeding the present outgoings.

Exports.—Members have again been very active in the export markets, and practically the whole of the remaining trade of the reproduction section has gone to the dollar area. Even more dollar exports could be achieved if the authorities could be made to see that, so far as this country is concerned, the use of the metal should be viewed, not so much as the goods which are made from it, as the production of dollars. The end use of goods is surely the concern of the importing countries, which have not prohibited local manufacture. Concern has also been felt at the development of quota restrictions against some goods, by the government of South Africa. Representations have been made, so far without success.

Building Programme

The considerably expanded building programme, coupled with similar developments in overseas markets, will undoubtedly strain the resources of this and other industries producing building fittings. It is apparent that some of the restrictions imposed by the Orders prohibiting certain manufactures will have to be modified if a serious " bottleneck " is to be avoided, since supplies of all alternative materials equally are short. Moreover, the recognition of the industry's considerable responsibilities to the housing programme conflicts, to no small extent, with its equally substantial export commitments to Commonwealth and other countries. This is true of those sections affected by the prohibition Orders, no less than of those unaffected. It can be said that, given a fair share of available materials and reasonable freedom, this industry will not fail the Government in its efforts to provide the houses.

Taxation.—The Association has continued in co-operation with other trade organizations, to press for relief of the burden of taxation and the need for economy. It has particularly referred to the disastrous effect of death duties on family businesses, the inadequacy of allowances for depreciation, and has secured several minor modifications in the application of purchase tax. In this latter connection, Mr. C. I. Thomson has been appointed to represent the industry on a joint trade committee which is in close negotiation with the Treasury.

National Brassfoundry Association

Price Control.—During the year, the Association had no option but to enter into an agreement not to advance the prices of builders' brassfoundry, cabinet brassfoundry and stamped brassfoundry, without first consulting the Central Price Regulation Committee. Whilst accepting the necessity for control, where prices have risen above a reasonable level, we cannot but feel that its application to a trade whose prices are so moderate and whose output has been so severely curtailed, was inequitable.

Productivity

The brassfoundry productivity team's excellent and comprehensive report has now been published and has received widespread acclaim. A conference of executives was held in connection with the report, which was very well attended and a further conference is to be held later in the year, at Harrogate, when the various aspects will be considered in detail. Arrangements for this conference are in the hands of the Association of Bronze and Brass Founders, who are more concerned with the foundry side of the industry than are the makers of "end products," as represented by the National Brassfoundry Association. The Council is, however, delighted at the continued close co-operation and friendly relationships that now exist between the two Associations, and will do everything in their power to maintain this state of affairs, which is so much to mutual benefit. The film, "The Brass Trail," has been in regular use by numerous borrowers, and the demand continues.

Labour.—The rare incidence of a strike has been experienced, in the South Wales works of one of the members, and this was settled completely to the satisfaction of members. The strike was unofficial and arose from the member's insistence on the observance of the agreements for the brassfoundry industry. The Association enjoyed the full support of the National Society of Metal Mechanics, so that the unbroken record of the absence of disputes within the agreements still holds. In general, the Association has again had a quiet year, and the helpful attitude of the Union is appreciated.

Congratulations

John Webb & Company, Limited, held special celebrations in respect of their 115th anniversary, and the Council offers special felicitations to Mr. Timothy Colman and his three sons on the immense expansion, coupled with equivalent goodwill, which their company has enjoyed during recent years. Smith & Davis, Limited, celebrated their golden jubilee, and also opened new premises at Wednesbury—one of the finest factories, both in buildings and layout and in equipment, that the industry possesses. Third generations of each of the two families represented in the firm's title have now joined the firm, and we wish them every success, coupled with early relief from the restrictions which limit the developments that their new premises will, in due course, provide. Dodd & Oulton, Limited, celebrated 100 years of successful trading in Liverpool. Mr. George Gummer* the president-elect, enters office at a singularly propitious time, having entered the industry just 50 years ago.

Office Accommodation

Very considerable anxiety is felt about the future of the Association's office accommodation. The present lease expires in March, 1953, without any real hope of renewal. For the past three years a continuous search has been made for new premises, without success. Many places have been seen, but have either proved unsuitable or far too expensive. The Association prefers somewhere reasonably central, and is prepared to buy a house suitable for conversion, where Town Planning permission can be obtained. Failing that, it may be necessary to move away from the centre and then to take smaller premises, without a board-room, hiring accommodation at hotels, etc., when meetings are necessary. As the lease runs out, the position becomes increasingly serious and urgent, especially in view of the Government's decision strictly to limit building of this type.

Business of the Association

The past year has been the most strenuous that the Association has ever known, and has certainly been one in which the Association has faced its greatest crisis. This has entailed a great deal of discussion and work, particularly by the members of the president's committee, to whom the Council offers especial thanks.

Thanks are also offered to the hon. treasurer, Mr. R. P. Allday, and the finance committee. The measure of the work of this committee is shown in the satisfactory state of the accounts, and the restriction on expenditure that is evident, notwithstanding rising costs. The staff has not yet been increased, although a good deal of overtime has been necessary. The load of work varies considerably at different periods of the year.

A most pleasing record of attendances by members at meetings has been noted, and it is felt that members appreciate the Association's efforts, even when the concessions sought have not always been obtained. It is a matter for serious thought as to what would have become of the trade, if it had not had a strong, united and influential Association to fight its battles. In the same spirit of unity and friendly co-operation, the members will survive these critical times.

The Report is signed by Mr. H. Norman Wright, president, and Mr. Edgar N. Hiley, secretary.

The following officers were also elected at the annual general meeting:—As *senior vice-president:* Major R. C. Watts, M.C. (T. J. Cooke & Son, Limited); as *junior vice-president:* Mr. C. W. Parkes, J.P. (Josiah Parkes & Sons, Limited); and as *hon. treasurer:* Mr. R. P. Allday (P. G. Allday & Company, Limited).

* See page 440 of this issue.

THE NEXT of the great annual meetings of the British Association will be held in Belfast from September 3 to 10, 1952, under the presidency of Prof. A. V. Hill.

Recent Development of Cupola Design with Special Reference to Hot-blast*

By Dr. Ing. Fritz Schulte

(*Continued from page* 414)

Melting with Oxygen Addition

The effect of oxygen on flame temperature and coke consumption is shown in Fig. 16. The theoretical flame temperature is increased very steeply by oxygen addition to the combustion air. For comparison, the blast temperatures required to produce similar flame temperatures have been taken from Fig. 7, and it appears that preheating the blast to about 1,000 deg. C. would have the same effect on flame temperature as an oxygen content of about 30 per cent. in the cold air-blast. Beyond about 2,500 or 3,000 deg. C. the curve for flame temperature becomes rather uncertain, as no reliable specific heat values are available for the combustion products, and also a considerable dissociation of these products will take place.

The effect of increased oxygen content in the combustion air has surprisingly little effect on the quantity of coke required to melt the iron to the same temperature as with cold blast with normal oxygen content. A small saving will be obtained, but, if the same theoretical flame temperature is produced by preheating the blast instead of oxygen addition, much less coke will be required. This result, surprising as it may seem at first, becomes understandable if one remembers that by oxygen addition a saving will mainly be obtained, because less nitrogen carries sensible heat away in the cupola exit gases.

As previously shown, the amount of sensible heat in this gas is only about one-third of the total heat content. Not much can be saved out of this by decreasing the nitrogen content by a few per cent. The combustion ratio $\frac{CO_2}{CO_2 + CO}$ is affected in the same direction as with hot blast, and no saving can therefore be expected by more complete combustion to CO_2. Jungbluth states that an oxygen addition has a very similar effect as the preheating of the blast: higher combustion temperature, increased output, CO formation in the upper part of the shaft, and correspondingly lower top-gas temperature. Fig. 17, taken from his publication, proves these points, but it also gives an indication that the coke saving cannot be appreciable. Both blast preheating and oxygen addition can be used to obtain high metal temperatures, but they are not the easiest means for controlling metal temperature within close limits and neither ameliorates the most serious drawback of the cupola: the difficulty of preventing temporary variation of the metal composition.

* Paper read before the Birmingham branch of the Institute of British Foundrymen with Mr. T. R. Twigger in the Chair.

Induction Heating Addition

Piwowarsky[14] has made the interesting suggestion to combine the cupola with a special type of low-frequency induction furnace (Fig. 18). This furnace is operated at 50 cycles and has a cylindrical, water-cooled coil, surrounded by six iron cores, made up from packs of transformer sheet. This low-frequency furnace differs from the conventional designs by not having any induction channels for the molten metal, which would be extremely difficult to maintain at the high temperatures required for grey and malleable irons. As all the melting work is done in the cupola, very little electric power is needed for superheating the iron in the electrically-heated part of this combination. Piwowarsky quotes as the result of his tests that 1 ton of iron can be superheated by 100 deg. C. with a power consumption of about 50 to 60 kwh. Thus the arrangement suggested by Piwowarsky permits an easy control over iron temperatures, and it will also have some equalizing effect on the metal composition simply through its storage capacity for molten iron. It does, however, not

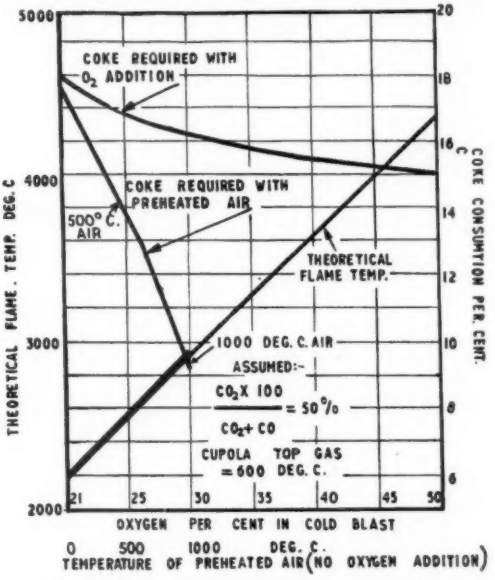
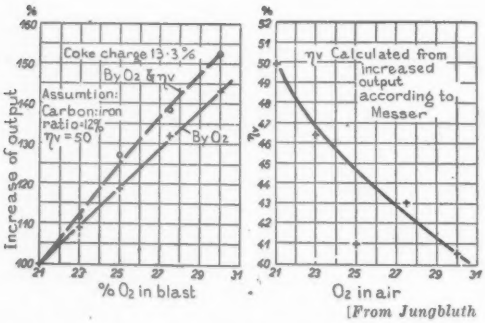


FIG. 16.—*Effect of Oxygen Enrichment on Theoretical Flame Temperature and Coke Consumption (for comparison with Air Preheating).*



[From Jungbluth

FIG. 17.—*Relation between Output, N_v, and Oxygen Content.*

provide the possibility of deliberate alteration of the metal composition by addition of steel scrap or alloying elements.

This can be achieved by the use of a heated forehearth. Heating can be by gas, oil, or electricity. Fig. 19 shows an electrically-heated forehearth, which is in effect a small arc furnace without tilting mechanism. Iron from the cupola is fed into this forehearth through a launder and is tapped off into hand shanks after superheating. With this arrangement, too, power consumption for a 100 deg. C. Superheat remains in the region of about 50 kwh. per ton, as long as no appreciable amount of cold alloy addition is made. Power consumption will, of course, be higher if a high percentage of cold steel scrap is added to lower the carbon content of the iron, as is, for instance, done in the duplex melting of blackheart malleable iron.

DISCUSSION

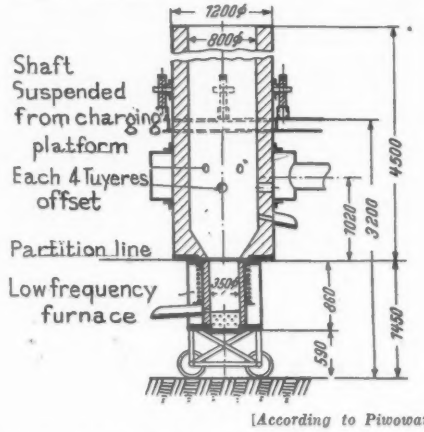
MR. W. J. DRISCOLL proposed the vote of thanks to Dr. Schulte for the lecture which had been both refreshing and informative, particularly with regard to the fundamentals relating to cupola operation.

Many points which Dr. Schulte had shown originated from a diagram by Piwowarsky and Kramer which gave an indication that a certain metal temperature could be obtained dependent on the air supply, and in turn on the coke ratio. Mr. Driscoll also referred to a diagram showing a cupola with a tuyere ratio of 60:1 and said he was not surprised to find this, as he had always felt that tuyere areas could easily be that small, and could have advantages, particularly from the point of view of reduction of slagging. He said he thought any prejudices against small tuyeres which did exist, resulted from people who had tried them and obtained poor results because they were blowing the furnace with a fan, which meant that the volume being supplied was conditioned by tuyere size and was below the optimum. He asked whether Dr. Schulte had yet any confirmation that a high percentage of steel gave a reasonably high carbon content and also reduced silicon losses. Finally, regarding the last two illustrations, one showing the hot-blast cupola incorporating an induction furnace, and the second showing a direct-arc furnace, it called to his mind that in fact in a foundry in the neighbourhood, the whole of the cupola had in fact been converted into a direct-arc furnace by three electrodes being used in the walls.

MR. E. HUNTER said he was very happy to be associated with Mr. Driscoll's remarks, and specially also, with those on tuyere areas. There were one or two points he would like to raise, particularly in regard to the design side of the hot-blast cupola. He had noticed that Dr. Schulte had said that the hot gases in most of the designs were on the outside of the recuperator tubes. He thought that it had been found that the dust which went through a recuperator was very adhesive and was inclined to stick to the tube walls, and that, particularly in the United States, it had been found that when the hot gases were on the outside of the tubes there was considerable difficulty in cleaning them, whereas if they were passed inside the cleaning was very much easier. Mr. Hunter referred to the question of hot-blast temperatures and said that at the moment, particularly in America, there was quite a controversy around the question of optimum temperature. There were two distinct camps, some being quite satisfied that a temperature of 200 deg. C. was a good one, while others wanted 450 deg. C.

Size Ratios

DR. SCHULTE, answering Mr. Driscoll, thought that once a specific air-flow was started with, then it should be carried on throughout the day, but this was not possible because the lining was altering in shape continually. Regarding area ratio of tuyere and furnace, he had shown the first example because he thought that it was a point where someone had made a very good device with recognized practice throughout the world and with great success, and by doing that had achieved a self-repairing lining. He pointed out that the results were obtained on a cupola of about 12 in. dia. and said he thought Mr. Driscoll should be guarded about applying them to a larger furnace.



[According to Piwowarsky

FIG. 18.—*Schematic Section through Low-frequency Induction Cupola of Four Tons per hr. Output.*

Regarding Mr. Hunter's remarks, he had shown two designs of the hot-blast cupola, one with recuperator tubes outside and one showing gases passing inside. He could only show these as two possibilities which apparently did work. Regarding optimum temperatures for cupola blast, work had been started on this a few years before the war, and at that time discussions were proceeding as to whether it was wise to preheat the blast. At present, according to publications about hot blast on the Continent, he gathered they normally tried to establish that 400 to 500 was the correct temperature range and not higher temperatures.

Risk of Explosion

MR. MORGAN asked if Dr. Schulte had any knowledge or experience of the dangers of explosion in the recuperators, and asked whether if air was mixed with the waste gases to the extent of below 5 per cent., would Dr. Schulte still consider there was sufficient heating value in the mixed gas to warrant the use of a recuperator.

DR. SCHULTE replied that it was not so easy to burn the cupola top gas at all, and that normally if a mixture of gas and air was made, it could be dangerous when cool or semi-cool. Once it was "red" hot then the mixing of gas and air always had the effect of flame combustion and not explosion.

MR. MORGAN then asked whether Dr. Schulte thought it was at all advantageous to dilute the waste cupola gas from the stack to such an extent that it would not ignite.

DR. SCHULTE said that if he did this, then use would never be made of the latent heat in the cupola.

A MEMBER, referring to the water-cooled duplex cupola shown in one of the illustrations, said he understood that towards the latter end of the last century in America there was developed a centre tuyere and one of the advantages claimed for it was reduced erosion on the cupola wall. He asked Dr. Schulte if he could say why this method had gone out of favour and whether it was a fact that the device lived up to the claims made for it.

DR. SCHULTE said that he had heard of it but it seemed to him very difficult to maintain the wall of the centre tuyere, and that a roof would be required over it and exits to the side. These, he thought, would constitute an extremely difficult maintenance problem inside the cupola.

Metal Temperature

MR. WRIGHT referred to metal temperatures, and said that whilst an advantage might be obtained with hot blast and oxygen enrichment, was it certain that that was the correct thing to do metallurgically for cast iron. For 20 or 30 years complaints had been made about the deterioration of pig-iron, as to its annealability, chill etc., and he asked whether with these excessive temperatures obtained with hot blast, whether there was a danger of a further reduction of all-important elements which had a profound effect on the metallurgical structure of iron.

DR. SCHULTE replied that the question was not an easy one to answer, as there was as yet insufficient experience with hot-blast cupolas, they

[Courtesy Birlec, Limited

FIG. 19.—*Electric-arc-heated* (200 *k.v.a.*) *Forehearth of One Ton Holding Capacity and Three to Four Tons per hr. Throughput.*

having so far mainly been concerned with malleable iron.

MR. HIRD asked whether Dr. Schulte could say if he had any data on the effect of carbon pick-up with hot-blast cupolas.

DR. SCHULTE replied that it was claimed with the hot-blast cupola that pig-iron could be saved by charging steel scrap, and that sufficient carbon pick-up was obtained.

MR. MILLINGTON said that he believed that so long as the hot-air temperature was kept below 500 deg. there was not much trouble with dust sticking to the tubes of a recuperator. Regarding high-duty iron, he had had experience in Germany working with blast at 420 deg. C., and had found no difficulty in control.

DR. ANGUS said that one repeatedly heard remarks deploring the falling-off of quality nowadays and there had been much talk of hot blast affecting the structure of the metals, but the real answer was that there was probably only very few hot-blast cupolas in this country. If the quality from these was so very much better, then more than those already working would be required to fulfil the demand. If the economic properties were good then it was fairly safe to assume that at least the risks were not undue. He thought it could be safely said, however, that the higher the temperature, the more difficult it was to control the reactions.

DR. SCHULTE said that there were certainly a number of economic considerations which came into building a recuperator. The cost was quite high, more than that of the cupola itself, and if the cupola was only running for a few hours a day, then it was questionable whether the capital outlay was worthwhile. The best use which could be made of such a pre-heating system would be where two full shifts were working per day.

Other Relevant Considerations

MR. HALL said he disagreed with Mr. Wright and agreed with Dr. Angus regarding hot blast and its effect on iron, in that it should not be condemned. He believed that coke from Germany had been inferior to that used in this country prior to the war, and thought our coke in turn would deteriorate, whether we liked it or not. Also, he would like to ask Dr. Schulte a question regarding maximum air temperature. Dr. Schulte had given certain tuyere areas as being the recognized practice and had then pointed out a certain anomaly. The point he did not mention was that if pre-heating the air increased the volume of the air, then the limits in temperature may be in some way connected with the tuyeres. It may be that the foundryman had not yet found the "absolute" tuyere area or dimensions to suit the hot blast. Another point was that in the designs of recuperators which Dr. Schulte gave, it seemer to him that the air passed through laterally parallel tubes, *i.e.*, there was a possibility in all of them of getting a considerable back pressure, and he asked whether it would be correct to adopt the counter-flow method, *i.e.*, of bringing the air in in small-diameter tubes, and taking it away in large-diameter tubes, thus compensating for the increased volume and therefore the increased back pressure of the air.

DR. SCHULTE said that regarding tuyere areas, the cupola he had shown with the ratio of 60:1 was operated with cool air. The other point concerned the increase in volume if the air was heated—certainly there was a higher linear speed as the air passed through the tubes, but it was not only the speed that mattered but the specific weight of the air as well, and this was more or less compensated. For a given output of molten iron, less air was used because less coke was consumed.

MR. MILLINGTON said that usually the air ratio was 3 : 1.

Slag Reduction

MR. J. W. DEWS said he had gathered from Dr. Schulte that emphasis was laid on the benefit from a hot-blast cupola in conjunction with water-cooling; later, Dr. Schulte had said that, by water-cooling, a certain amount of heat was taken out of the cupola which necessitated using more coke. Mr. Dews asked whether there was a possibility that slag was reduced as a result of using a water-cooled cupola.

DR. SCHULTE said that the question of slag production was quite an important one from a different point of view, and it might be that by reducing the quantity of slag a saving of coke might be made.

MR. SHAW said he would like to add something on the question of carbon pick-up when using hot blast. Using 100 per cent. steel scrap, he was obtaining 3.65 per cent. total carbon with a 4½ per cent. silicon iron.

MR. HALL referred again to tuyeres and said he had had an opportunity of seeing in France a type of cupola in which they had four tuyeres opposite each other, and another four inset between, and every ten minutes the blast was alternated between the groups. With this method, they worked for over a week without having once burnt the tuyeres. It was claimed to give complete freedom from tuyere choking, this being on a cold-blast cupola.

MR. WEAVER, from a purely production point of view, asked Dr. Schulte if he was faced with the problem of laying-out a foundry, what type he would prefer to install, hot or cold blast or with an electrically-heated receiver.

Economies of Operation

DR. SCHULTE said that if a method of pre-heating the blast could be obtained wthout paying for it, that was an advantage. It depended very much on what was being made. Could Mr. Weaver give him some indication of this.

MR. WEAVER replied that he had in mind general-engineering grey-iron production.

MR. TWIGGER said it depended on the output per day or per hour. He thought it was quite clear that no-one would consider a hot-blast installation unless the cupola was of considerable size, and unless metal was flowing for at least 6 to 8 hrs. per day.

MR. WEAVER said it therefore appeared to him that, with a general type of foundry, hot blast was not so necessary.

MR. HUNTER said that if a cupola was to be run for more than 8 hrs. a day the question of hot blast should be looked into.

MR. HALL said he thought that in this country founders were a little over-afraid of the first cost of installation. However, if the size of the cupola was small, then it would not be worth while installing a hot-blast plant.

Refractories and Carbon Pick-up

MR. SHAW mentioned refractories, and asked whether there was any member present who could give any indication of the way refractories obtainable in this country behaved under hot-blast conditions.

DR. SCHULTE said that the total consumption of refractories remained the same, and that instead of having a fairly high zone where the refractory was attacked, it was attacked more deeply but in a localized zone.

MR. TAFT referred to the economic operation of hot-blast furnaces and the ability to pick-up carbon, and said he would like to support Mr. Wright about the possibility of the effect on the metal control aspect of the material. He said that although Mr. Hunter had had experience of operation in America, he would like to ask whether he had any experience of foundries where hot blast was used and yet the foundry was producing high-duty metal.

MR. HUNTER said he had, and in one plant, which had 26 cupolas on hot blast, the blast temperature had been reduced and the cupola was working under rigid control at a blast temperature of about 270 deg. C.

DR. SCHULTE said that if heated air was used in the cupola, the composition of the metal may be different from that expected under cold-blast working because reactions were quicker; this must be compensated for.

MR. J. L. FRANCIS said that it seemed to him that with hot blast and a great speed of reaction, there was a greater risk of getting oxidized iron, and that the higher speed of reaction or pressure would have a bearing on this.

DR. SCHULTE said the phenomenon of silicon reduction at high temperature was used in making high-quality steel in the crucible, when the silicon was reduced out of the crucible wall and looked after the oxygen content in the iron—which seemed to him a contradiction.

MR. WRIGHT said that Dr. Angus had taken up his point on the old-fashioned cold-blast furnace *versus* the hot-blast as he anticipated he would. In the roll foundry in which he worked they made a good product to-day, but he thought the raw materials were becoming more and more difficult to obtain. He maintained that, in the past, irons permitted more latitude in pouring, charge make-up, etc. Regarding temperatures, he said this might not be related to tapping temperature or casting temperature, but to a temperature at which the metal had been subjected at some point in the melting process, and for massive castings, the danger of high melting temperatures, coupled with a high casting temperature, was appreciated.

MR. TWIGGER at this point had to bring the discussion to a close, and again thanked Dr. Schulte for his lecture and his able handling of the discussion.

Anti-corrosion Lectures

Commencing on April 26, a course of six lectures on "The Corrosion and Protection of Metals and Alloys" will be given on successive Saturdays at 10.15 a.m. at the College of Technology, Suffolk Street, Birmingham. The lectures have been arranged by the City of Birmingham Education Committee in collaboration with the Corrosion Group of the Society of Chemical Industry.

The programme of lectures is as follows:—APRIL 26: "The Theory and General Principles of Corrosion," by Dr. W. H. J. Vernon; MAY 3: "The Corrosion of Iron and Steel," by Dr. J. C. Hudson; MAY 10: "The Corrosion of Non-ferrous Metals," by Dr. P. T. Gilbert; MAY 17: "General Principles of Protection Against Corrosion (including Inhibitors)," by Dr. W. H. J. Vernon; MAY 24: "Preliminary Preparation of Metallic Surfaces, and Protection by Metallic Coatings," by W. E. Ballard; MAY 31: "Protection by Phosphating Processes," by H. A. Holden, and "Protection by Paint," by W. A. Edwards.

Each of the first five lectures will be of approximately 1½ hours' duration and will be followed by discussion. At the final meeting, two lectures, each of approximately 1 hour duration, will be given, followed by discussion.

THE LORD MAYOR OF LEEDS paid an official visit recently to Yorkshire Copper Works, Limited, Leeds.

German Iron and Steel Production

Production of pig-iron and crude steel reached record levels in Western Germany in March. Pig-iron production totalled 1,058,000 metric tons, against 988,000 metric tons in February. Output of crude steel amounted to 1,318,000 metric tons, against 1,232,000 metric tons.

The March production of crude steel is equivalent to an annual rate of 15,800,000 metric tons. This figure is well above the 15,000,000 metric tons previously put out as the total crude steel making capacity. In Düsseldorf the increase in production is regarded as a further argument in favour of the freeing of steel prices; but consumer interests, especially in the south-west, are opposed to the removal of price control.

IN A MEMORANDUM to the Ridley Committee on National Fuel Policy, published in the spring issue of the society's journal, "Smokeless Air," the National Smoke Abatement Society has urged that due weight be given to the social costs resulting from the use or misuse of fuel, of which the most serious and extensive is that due to smoke. Among the society's proposals on fuel policy, the most distinctive is that for the prior approval of all new fuel-burning installations in industry.

THE SKYLON on London's South Bank site has been bought by George Cohen Sons & Company, Limited.

Foundry Extensions and Modernization

There is little prospect of an early relaxation in the restrictions imposed on founders wishing to extend and modernize plant which have followed the Government's decision that civil investment must be curtailed this year. The Ministry of Supply will continue to consider foundry applications for building licences, each on its merits; but it seems that approval will have to be confined to the most important and urgent schemes, and others may have to be deferred. The latter remark applies particularly to expansion schemes which would require extra supplies of raw materials; these will be deferred unless the Ministry is entirely satisfied that additional capacity for the types of castings concerned is essential, or that the applicant is engaged on work of exceptional national importance. Repair work or replacements of essential plant will be authorized where the work cannot be deferred, but companies generally will be expected to defer the erection of new buildings or the reconstruction of existing buildings, unless structures are dangerous or unless the expenditure and the amount of steel involved are very small.

Unfortunately the restrictions extend also to the provision of amenities, and in general, unless circumstances are exceptional, founders will be requested to defer their amenities schemes. It should be realized that these restrictions apply to all branches of the iron and steel industry, and the foundry industry will be treated not less favourably than the other sections. In the meantime, the steering committee of the Council of Ironfoundry Associations will continue to advise the Ministry of Supply in respect of the technical aspects of the schemes of member firms.

Alloy Steel Arrangements

Arrangements for economizing in the use of nickel and molybdenum in alloy steel, and for increasing its production, have been worked out by the Ministry of Supply with the alloy-steel makers and the main consumers. The arrangements which are already in operation to a substantial extent become fully effective on June 2. In order that they should be applied generally, the Minister of Supply (Mr. Duncan Sandys) has issued directions to steelmakers.

Certain special types of alloy steels, such as tool steels and those designed to resist heat and corrosion, are not affected. Apart from these, the general effect of the directions is to divide alloy steels containing nickel or molybdenum into three groups.

These are:—(*a*) Those containing little nickel or molybdenum which may be supplied to any consumer of alloy steel up to the quantity for which he holds an authorization under the steel distribution scheme; (*b*) those, somewhat richer in these elements, which may only be supplied for particular purposes; (*c*) those, richer still, the supply of which is prohibited except as specifically approved.

A consumer who considers it essential to use alloy steel which cannot be supplied without special authorization, may apply for this, in writing, to the Director of Alloy Steel Control, Ministry of Supply, Shell Mex House, Strand, London, W.C.2.

A CENTURION TANK, complete with commander and crew, who have served in Korea, are visiting Sheffield steelworks this week. The works to be visited include the East Hecla works of Hadfields, Limited, and the River Don and Grimethorpe works of the English Steel Corporation, Limited.

Quantity Production of Spheroidal-graphite Cast Iron

After Mr. N. Croft had presented his paper bearing the above title to the International Foundry Congress in Brussels* the following discussion took place.

PROFESSOR DE SY asked for additional and more exact information on the empirical tests used to determine before casting whether or not the iron had been completely treated.

MR. CROFT said a small ½-in. by ½-in. bar was cast. After two minutes it was broken, the fracture examined, and the efficiency of the treatment determined. Obviously, a certain amount of experience was needed to associate the treatment with the fracture.

MR. CHAVY said he made tests of a similar nature, but he used bars 1 in. by 2 in. by 8 in. long.

PROFESSOR DE SY commented that these bars were pretty large, and he asked whether time was not lost in the cooling of bars.

MR. CHAVY said that actually he had to wait several minutes.

MR. VAN BERGEN asked what percentage of steel was incorporated in the charge, and what pig-iron was used.

MR. CROFT said he had recourse to several brands of pig-iron, whilst usually 20 per cent. of steel was used. The material was cupola-melted.

MR. COLIN GRESTY asked if a ratio had been established between the fracture tests and the mechanical properties of the casting.

MR. CROFT, replying in the negative, said there was a relationship with the Brinell number. The specification to which he worked called for 40 tons per sq. in., with zero to 8 per cent. elongation as cast, and 25 tons per sq. in. with 8 to 20 per cent. elongation after heat-treatment.

PROFESSOR DE SY asked what was the initial sulphur content to which the Author gave the figure of 0.08 per cent.

Mr. J. E. Rheder presided in this short discussion, in which members of five nations participated, with a representative of yet a sixth (Canadian) presiding.

* Printed in the JOURNAL, January 3, 1952.

Heat-resisting Cast Irons

In his Paper to the Iron and Steel Institute, Mr. M. M. Hallett, M.Sc., on "Tests on Heat-resisting Cast Irons," included the following synopsis:—

The resistance to oxidation of a wide range of alloy cast irons has been determined in air and in a sulphurous atmosphere in the temperature range 750 to 1,050 deg. C. A clear comparison may be drawn between the various irons, and the effects of the alloying elements nickel, silicon, and chromium are illustrated. The growth of the scaled specimens was measured and their microstructures were examined. The mechanism of internal oxidation in the different materials was observed. Tests on the relative susceptibility to cracking of the same series of irons revealed characteristic differences. In line with the laboratory work, the same irons were cast into furnace parts and were subjected to normal furnace operations. The results of these service tests could be correlated closely with the laboratory test results.

Small alloy additions improve scaling at relatively low temperatures, and silicon is particularly good in reducing oxidation at temperatures up to about 900 deg. C. Above this its efficiency drops appreciably. The high-chromium irons are particularly resistant to the highest temperature studied, and are less prone to cracking than would be expected, provided that the sections are relatively thin so as to avoid thermal stresses.

Foundry Worker's Damages Claim

Lord Birnam has issued judgment dismissing an action in the Court of Session in which a Falkirk worker, after receiving from defendants in the action regular weekly payments of compensation under the Workmen's Compensation Act over a period of three years, claimed damages at common law. The plaintiff, John McKinlay, when in the employment of R. & A. Main, Limited, at the Gothic Iron Works, Falkirk, sustained severe leg injuries as a result of an accident. The accident occurred on February 18, 1947, and admittedly the plaintiff received from defendants regular weekly payments of compensation, which he knew were payments under the Workmen's Compensation Act, from the date of the accident until May 12, 1950.

In the present action, he claimed payment of £3,500. The defendants pleaded that the plaintiff, having exercised his option in favour of compensation under the Act, was barred by Section 29 (1) from presenting a common law claim in respect of the injuries. Lord Birnam heard proof upon the facts so far as affecting that plea. His Lordship said it was maintained on behalf of plaintiff that during the whole of the three years he was "ignorant of the fact that he had an option," and that accordingly he was not now barred from taking proceedings independently of the Act. In the light of the facts, it was in his Lordship's judgment clear that claimant had claimed and received compensation under the Workmen's Compensation Acts, and that he was therefore barred from claiming damages at common law. He would have reached that conclusion whatever might have been the state of claimant's personal knowledge or ignorance.

His Lordship declined to accept the unsupported statement of the claimant that he was ignorant of the law which entitled a workman to damages for injuries sustained through the negligence of his employers. On the other hand, he accepted his evidence that he was "ignorant that he had an option" in the sense, and only in the sense, that he did not know, and for three years had no reason to believe that the accident was due to defendants' negligence, and that accordingly he thought he had no alternative but to take compensation under the Act.

His Lordship was astonished to hear solicitors say in evidence that they deliberately refrained from telling claimant of his possible claim for damages in order that it might remain open to him to plead ignorance of his statutory option. No authorities cited to him went so far as to decide or even to suggest that a workman, either personally or by his solicitors, might claim and receive compensation under the Act, while at the same time investigating the question as to the employers' negligence with a view to a possible action of damages. Such an attitude was, in his opinion, not only contrary to Section 29 of the Act, but would place employers in an intolerable position.

Blast-furnace Coke Supplies

Stocks of coke at blast furnaces amount to 175,000 tons, or almost exactly the same as a year ago. This information was given by Mr. L. W. Joynson-Hicks, Parliamentary Secretary to the Ministry of Fuel and Power, in the House of Commons recently.

He also told Mr. G. R. Chetwynd that the question of increasing coke supplies to the steel industry was receiving consideration.

Obituary

MR. GEORGE R. BLACKSHAW, founder and a director of Glendale Engineering Company, Limited, Ponders End (Middx), died recently at the age of 49.

THE DEATH occurred recently of MR. JACOB HORACE BANKS, managing director of J. Banks & Company, Limited, lock manufacturers, of Willenhall (Staffs). He was 63.

THE DEATH is announced of MR. ORLANDO G. R. BEERE, A.M.I.MECH.E., A.M.I.P.E., director of the Selson Machine Tool Company, Limited, for the past fifteen years, on April 7, after a prolonged period of ill-health. Mr. Beere, who was in his 75th year, was well known throughout the machine-tool industry.

A PROMINENT FIGURE in the tin industry, LORD BROADBRIDGE, died suddenly on April 16 at the age of 83. In addition to being deputy-chairman of the Nigerian Chamber of Mines, he was at one time chairman of 14 companies concerned with the development and mining of tin. Lord Broadbridge, who retired from active business in 1928, was Lord Mayor of London at the time of the Coronation of King George VI.

MR. FRANK ARCHDALE who died at his Birmingham home on April 16 at the age of 73, was managing director of James Archdale & Company Limited from 1925 to 1951. During his connection with the firm, which was founded by his father, considerable development took place. The Company began with an iron foundry in Icknield Street, Birmingham, and a factory in Ledsam Street, but new premises were built in recent years at Blackpole, Worcester, which employed 1,200 operatives, and the business has since developed there rather than in Birmingham.

MR. WALLACE B. PHILLIPS, chairman and managing director of the Pyrene Company, Limited, fire extinguisher manufacturers, of Brentford (Middx), which he founded in this country in 1913, died on April 14 at the age of 66. An American by birth, Mr. Phillips was president of the American Chamber of Commerce in London from 1943 to 1951. He was treasurer of the International Chamber of Commerce for seven years. A member for 15 years of the executive council of the National Union of Manufacturers, he was a founder member of the Royal Society for the Prevention of Accidents.

International Mechanical Engineering Congress

The full programme for the fourth International Mechanical Engineering Congress to be held in Stockholm from June 4 to 10 has now been issued. Separate technical sessions will cover cast iron, ordinary steels, alloy steels, light alloys, powder metallurgy, non-metallic materials, and non-ferrous metals. Papers include "Engineering Properties and Applications of Spheroidal Graphite Cast Iron," by Dr. A. B. Everest, of the Mond Nickel Company, Limited; "Brittle Fracture of Welded Steels," by Dr. mont. Alois Legat; "Improved Basic-Bessemer Steel," by R. Langers; "Creep of Steel," by L. O. Bihet; "Testing of Heavy Forgings for Steam-turbine Sets," by R. Schinn; "Application of Boron-containing Carburizing and Heat-treatable Steel," by Dammer and Theis, and many other technical reports.

Spanish Iron and Steel Industry

The position of the Spanish iron and steel industry is discussed in an Overseas Economic Survey dated May, 1951, prepared by the Board of Trade and published by the Stationery Office (7s. 6d.). Recalling that the industry is mainly concentrated in the north-western provinces of Spain, the chief centre being in the Bilbao area in the vicinity of the Vizcayan iron-ore fields, the report states that the only large works outside these provinces is at Sagunto (Valencia), which is linked by rail with the ore mines at Teruel. Pig-iron production is almost entirely in the hands of six companies which account for over 95 per cent. of the total output. There are nearly 40 firms engaged in steel production, but a few large companies account for the greater part of total capacity, one alone producing over 60 per cent. of the total output. Steel output includes almost 23 per cent. Bessemer and 70 per cent. open-hearth, about 7 per cent. being obtained from electric furnaces. The number of workers employed in the iron and steel industry is estimated at 32,000, and there would be no difficulty in obtaining additional labour. The few large companies in whose hands the bulk of the industry is concentrated are closely associated with some of the principal Spanish banking groups. Production in 1950 included: Pig-iron, 652,100 tons (609,500 tons in 1949); steel, 818,200 tons (731,600 tons); rolled products, 492,000 tons (481,000 tons). Materials employed included: Coal, 1,843,000 tons (1,723,000 tons in 1949); coke, 780,000 tons (730,000 tons); iron ore, 1,348,000 tons (1,243,000 tons); scrap, 378,000 tons (327,000 tons).

The report says that there has been a steady increase in production in recent years, but, even so, output is still far below national requirements. The available supply of iron and steel products has had to be spread very thinly among a host of newly-developed secondary industries and in spite of endeavours to allocate supplies on a national basis, many of the more essential industries and public services, such as the State railways, have been sorely handicapped by shortages of steel. It is difficult to see how present plans for general industrial expansion can proceed on a sound footing without a commensurate increase in the production of iron and steel.

Problems Facing the Industry

The iron and steel industry is faced with three basic problems—the exhaustion of high-grade ore in the vicinity of the blast furnaces; an inadequate supply of suitable coking coal; and a shortage of scrap. These basic difficulties not only serve to limit output, but also contribute to the high costs of production. The exhaustion of the better grade Vizcayan ores has been offset by an increasing consumption of ores from southern Spain and Spanish Morocco; the high transport charges, however, drive up the costs of steel production, while the reduced exportable surplus of these ores adversely affects the country's foreign exchange earnings. An increase in Spanish coal production has been achieved only at high cost and at the expense of quality, and there is in any event a great shortage of coal suitable for the production of metallurgical coke. Regarding scrap, internal supplies are inadequate, but the Government has been unable to make substantial purchases from abroad owing to the international shortage. The deficiency of scrap aggravates the problems of the industry by necessitating a higher consumption both of iron ore and of coal.

Government Policy

The Spanish Government, in pursuance of its policy of national industrialization, states the report, has decided that the privately-owned iron and steel industry will be incapable of meeting national requirements, even after its present plans for rehabilitation and modernization have been completed. Accordingly, on June 15, 1950, it recalls a decree was issued by which the National Institute of Industry was authorized to promote a company to establish a new iron and steel works in Asturias. This new project, which would probably take about 10 years to complete, is planned for an eventual output of 600,000 tons of steel per annum. In the plans are to be incorporated the latest engineering developments with particular emphasis on the economic production of iron and steel from low-grade ore and locally produced coal and without the need for imported scrap.

World Steel Prices

Referring to the recent increases in steel prices, the January "Statistical Bulletin" of the British Iron and Steel Federation recalls that the increases were of varying amounts, typical examples being:—£3 7s. 6d. a ton on sheet and tinplate bars; £3 13s. on soft basic billets; £4 1s. 6d. on heavy sections; £4 4s. 6d. on light sections; and £4 7s. 6d. on plates. Notwithstanding these increases, however, reference to Table I appended, indicates that British steel prices in general remain below the world level. It should be noted that the French and Belgian quotations are for Bessemer steel and that open-hearth steel to which the British, American, and German prices relate commands a substantial premium in those countries.

TABLE I.—*International Home Trade Steel Price Comparison.* (*Per ton of* 2,240 *lb.*)

Product.	Size.	Quantity. Of a size.	Quantity. Order.	U.K.	U.S.A.	France.	Germany.	Belgium.
		Tons.	Tons.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Angles ..	5 in. by 5 in. by ½ in. ..	5	20	27 19 6	35 4 0	36 0 5	31 19 7	31 9 11
Joists ..	12-in. web..	5	20	28 0 6	34 16 0	34 9 10	30 0 6	31 12 10
Plates ..	20 in. by 60 ft. by ½ in. ..	5	20	31 16 6	35 12 0	41 8 2	33 6 9	37 8 3
Strip	3 in. by 10 g.	2	20	32 19 6	39 12 0	37 0 11	35 8 7	35 11 2
Rails	90 lb. per yd.	500	500	28 12 6	30 12 0	36 15 11	29 8 5	38 2 0
Sheets ..	6 ft. by 3 ft. by 20 g. ..	25	25	40 2 6	40 16 0	49 10 8	44 2 1	52 5 0
Tinplate (per basis box)	20 in. by 14 in., 108 lb. ..	50	50	2 15 11½	3 1 1	4 16 4	(*a*)	(*a*)

The general basis of comparison is tested steel, delivered to consumer's station (rails and tinplate—F.O.T. makers' works). The prices are for open-hearth quality except in the case of France and Belgium, where they are for basic-Bessemer quality. The extra for open-hearth quality is approximately £3 per ton in France and £10 per ton in Belgium.

(*a*) No comparable price available—quantities negligible.

Personal

PROF. W. J. KEARTON, Dean of the Faculty of Engineering at Liverpool University, has been elected president of the Liverpool Engineering Society for 1952-53.

MAJOR-GENERAL SIR EDWARD L. SPEARS has been elected as the president of the Institute of Directors for 1953. He will thus preside over the affairs of the Institute in its jubilee year.

On May 8 the DUKE OF EDINBURGH is due to visit the Abbey works of the Steel Company of Wales, Limited. While in Wales the Duke will also visit the University College of Swansea.

MR. HERBERT UNWIN, of Darlington Forge, Limited, has retired. Formerly with English Steel Corporation, Limited, Sheffield, he joined Darlington Forge in 1942 to take charge of the heat-treatment department.

MR. HENRY DUDLEY, of Derby, has retired after 42 years' service, with Aiton & Company, Limited, pipe engineers, Stores Road, Derby. He worked in the pipe-bender's department, and was the longest serving employee in the works.

MR. E. A. PHILLIPS, of Harper, Phillips & Company, Limited, ironfounders, Albion Foundry, Eastgate, Grimsby, took office on April 17 as president for the coming year of the Grimsby Institution of Engineers and Shipbuilders, in succession to Mr. A. E. Boaz.

A PRESENTATION has been made to MR. CHARLES LAMBERT to mark his retirement from the secretaryship of the Dinsdale Moor ironworks of W. Richards & Sons, Limited, Middlesbrough. During his 51 years with the company Mr. Lambert never lost a day's work.

SIR W. DAVID ROSS has retired from the chairmanship of the Civil Service Arbitration Tribunal and of four wages councils. In addition, he is retiring from the panel of the appointed members of the Industrial Disputes Tribunal. Sir David has been chairman of the Civil Service Tribunal since 1942; his connection with wages councils—formerly trade boards—is of long standing.

MR. G. W. QUILTER, of Peterborough, for some time foundry superintendent with Baker Perkins, Limited, engineers, Westwood Works, Peterborough, on April 16 took up his new managerial post at the Sheepbridge Company, Limited, works near Chesterfield. As a farewell gift, foundrymen at the Westwood Works presented him with a silver cigarette case and the works foremen gave him a clock, and silver forks for Mrs. Quilter.

THE MINISTER OF FUEL AND POWER has appointed MR. E. T. JUDGE, chief engineer and a director of Dorman, Long & Company, Limited, Middlesbrough, to be a part-time member of the North-Eastern Electricity Board. A graduate of Cambridge University, Mr. Judge joined Dorman, Long & Company in 1930, being appointed chief technical engineer in 1937. He was elected to the board in 1946. Among his other activities he represents the Ministry of Transport on the Tees Conservancy Commission.

MR. R. M. GRANT has been appointed assistant manager of the plant sales department of the British Thomson-Houston Company, Limited, Rugby. Graduating with honours from Glasgow University in electrical engineering, Mr. Grant joined the Company in 1929, and underwent a three-year student apprenticeship course. After four years in the construction department (London district), he joined the plant sales department (Rugby) in 1936. In 1946 he became the first leader of the hydro-electric section.

Beilby Memorial Awards 1951

The administrators of the Sir George Beilby Memorial Fund, representing the Institute of Metals, the Royal Institute of Chemistry, and the Society of Chemical Industry, have decided to make two awards, each of 100 guineas, from the fund for 1951. These awards have been made to DR. KENNETH HENDERSON JACK, in recognition of his experimental contributions to the study of interstitial alloys, especially in the iron-nitrogen and iron-carbon-nitrogen systems, and to DR. WILLIAM ARNOLD WOOD, in recognition of his experimental contributions to knowledge of the mechanism of deformation of metals.

Educated at Tynemouth Municipal High School, North Shields (Northumberland), and Armstrong College (later King's College), Newcastle-upon-Tyne, Durham University, where he graduated in 1939 with first class honours in chemistry, Dr. Jack spent a short period at the Chemical Defence Research Establishment, St. Helens, afterwards returning to King's College, first as a demonstrator and then as a lecturer in physical chemistry. In 1945 he joined the British Iron and Steel Research Association and carried out chemical and structural investigations on the iron-nitrogen, iron-carbon-nitrogen, and iron-carbon systems. He returned to King's College in 1949, this time as a lecturer in the inorganic chemistry laboratories. Recent work of Dr. Jack and his associates is concerned with the cobalt-carbon-nitrogen system and with the aging of nitrogen ferrites.

Dr. Wood joined the National Physical Laboratory, Teddington, in 1928 after graduating with first class honours in the Physics School, University of Manchester. In 1935 he was seconded to work with Dr. H. J. Gough on the structural changes produced by the fatigue stressing of metals and for his part in these researches was awarded the D.Sc. degree. Later he developed apparatus for precision measurements of the atomic spacings of metals under stress and obtained the first stress-strain curves for the atomic lattice of a metal. In 1947 he was appointed Senior Research Fellow, with the status of Associate Professor, in the metallurgy research department of the University of Melbourne and has been responsible for new observations on the mechanisms by which metals deform at elevated temperatures.

F.B.I. President Re-elected

At the annual general meeting of the Federation of British Industries, Sir Archibald Forbes, the retiring president, was unanimously elected to continue in that office for another year. It was in April of last year that Sir Archibald, who is an executive director of Spillers, Limited, flour millers, and chairman of the Debenture Corporation, was first elected to the presidency of the F.B.I. Aged 49, he served as chairman of the Iron and Steel Board, consisting of representatives of both sides of the industry and independent members, from its inception in 1946 to its termination in March, 1949. Educated at Paisley and Glasgow University, he served his articles with Thomson McLintock & Company, chartered accountants, and became a partner in that firm in London, resigning in 1935 to enter industry.

Sir Archibald has a long and distinguished record of public service. From 1932 to 1939, he was a member of various commissions and committees appointed by the Minister of Agriculture. In 1940 he served as director of capital finance at the Air Ministry, holding various appointments at the Ministry of Aircraft Production from that time until 1945.

News in Brief

FOUNDRY EQUIPMENT LIMITED of Lindslade Works, Leighton Buzzard, Beds, are exhibiting at the Milan Fair (April 12 to 26). The firm's Sandrammer equipment is being shown in operation.

THE STEEL BUSHES referred to in a short paragraph in our issue of March 27 should have been described as the Walter Patent Hardened Steel Bushes. These are available from Self-priming Pump & Engineering Company, Limited.

ONE of the "plum" shipbreaking jobs of recent years—the scrapping of the 21,833-ton Canadian Pacific liner Empress of Australia—has come to Scotland. The job will be handled at the Inverkeithing yard of Thos. W. Ward, Limited.

"GIESSEREI," the German foundry magazine, has published a special edition to help to publicize the Hannover Technical Exhibition being held from April 27 to May 6 this year. Many of the advertisements appear in colour. It is a very handsome issue.

THE MARCH MEETING of the Institute of Australian Foundrymen (Victorian Division) was devoted to the showing of industrial films. Included in the programme was "Flawless and British," a film made in the works of F. H. Lloyd & Company, Limited.

THE BRITISH ELECTRICITY AUTHORITY has agreed to a standard form of clause for endorsement on existing electricity-supply agreements, covering the use of private generating plant. Existing agreements will not be recalled for endorsement, except at the consumer's request.

BY ORDER OF THE GERMAN RESTITUTION COURT in Berlin, the works of WEMAG Eisengiesserei Erich H. Salinger has been returned to the ownership of Mr. E. H. Salinger, M.I.B.F., of 25, Queens Court, Queensway, W.2, who has been a resident in this country since 1939.

METRONIC INSTRUMENT COMPANY, LIMITED announce that they have instituted a free technical cupola service available to all foundrymen in Great Britain. The service is intended to deal with such troubles as bridging, undue lining wear, cold metal and so forth. Enquiries should be addressed to the Company at Ettingshall, Wolverhampton, marking envelopes T.C.S. for the receipt of a questionnaire.

MR. G. H. SAVAGE, works director of the Rover Company, Limited, Birmingham, is to represent British employers at the fifth conference of the International Labour Office Metal Trades Committee to be held in Geneva at the end of this month. The conference is to discuss recent developments in human relations in the metal industries, and to collate and analyse recent data covering factors affecting productivity in the metal trades.

SIR WALTER MONCKTON, Minister of Labour, stated in the House of Commons that the number of man-days lost through industrial disputes for each of the years 1946 to 1951 was approximately as follows:—1946, 2,158,000; 1947, 2,433,000; 1948, 1,944,000; 1949, 1,807,000; 1950, 1,389,000; 1951, 1,694,000. The number of cases referred to the National Arbitration Tribunal was:—1946, 142; 1947, 164; 1948, 174; 1949, 247; 1950, 239; 1951 (to August 13) 208.

THE ATTENTION of the Council of Ironfoundry Associations has been drawn to the serious increase in insurance premiums brought about through the large increase in claims against employers since the passing of the Industrial Injuries Act and the abolition of the defences of common employment and contributory negligence. The director is therefore to consult with other employers' organizations to investigate what joint action might be taken in the matter.

Two contracts amounting to nearly $500,000 (£178,570) have been obtained by the American offices of Thermotank, Limited, the Glasgow firm of air-conditioning consultants and engineers. Much of the specially designed equipment will be manufactured in the firm's three Glasgow factories. This is the first time in recent years that a British air-conditioning company have been able to secure contracts of this size in face of very keen competition from American industry.

WHEN HE PRESENTED long-service awards to 282 employees of the firm's metals division at Witton on April 18, Sir Ewart Smith, technical director of Imperial Chemical Industries, Limited, referred to a big industry's "major effort to fight inflation and keep prices at such a level that a pound note would buy what used to be a pound's worth of goods." Sir Ewart went on to say that while the general price of wholesale commodities had gone up since 1938 by 208 per cent., the selling price of all I.C.I. products had risen by only 82 per cent.

WHEN HE OPENED the new 2,000-ton extrusion plant at the works of the Aston Chain and Hook Company, Birmingham, recently, Sir Peter Bennett, Parliamentary Secretary to the Minister of Labour said that we had not lost our craftsmanship, as many insisted. He claimed "All we have done is shift our craftsmanship from one end of the job to the other. Instead of making wonderful articles by hand for the wealthy few, we are making machines which produce wonderful articles by the hundreds to go into everybody's homes." British craftsmanship is to-day as great as ever it was Sir Peter concluded, and in creating that craftsmanship Birmingham has given the lead.

FOUNDRY SERVICES announce that Mr. W. D. Cutler, who for the past two years has been one of their representatives in the Lancashire area, is moving early next month to Italy to become their resident technical representative there. Mr. Cutler will co-operate with Ditta A. Cesana, Via San Marco No. 50, Milan, the company's agent. Mr. R. A. Blincoe, who has recently joined the company, will shortly take over the Lancashire area. A further development in the firm's overseas representation is the formation, in association with their agents, Firma Hugo Wachenfeld, of a manufacturing company in Germany. The range of products at first manufactured will be limited but will be increased as rapidly as possible.

A NEW BLOCK of buildings at the county education committee's School of Engineering at Burnbank, Lanarkshire, estimated to cost about £40,000, will be ready for occupancy when the new session starts in August. Work on the block began in July last year. The extension will enable the number of students at the school to be considerably increased. At present there are 75 pre-apprenticeship, 600 part-time day-release, and over 1,500 evening-ciass students attending the centre. The new building is a single-storey construction consisting of machine-shop, electrical installation, patternmaking, mining and hydraulics, mechanical engineering and chemistry rooms, and two lecture rooms. Among the subjects taught at Burnbank are foundry work, welding, metal work, electrical engineering, mechanical engineering, constructional engineering, railway wagon building, and automobile engineering.

NEW

CHELFORD

Processed Washed Sand

A modern plant has been installed for the washing and grading of Chelford Sand. This plant is of the latest and most efficient type and Chelford Processed Sand can now be supplied thoroughly washed and in two grades, coarse and fine. The chief features are as follows :—

COARSE GRADE

Grading mainly between 30 and 85 mesh B.S.S. and practically free from fines below 85.

Uniform grading gives closer control of mixtures.

Increased permeability.

Negligible clay content.

Superior to natural sand for special purposes e.g. synthetic moulding mixtures, cement moulding process, etc.

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Excellent for fine cores and for addition to facing sand mixtures where smooth finish is desired.

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Raw Material Markets

Iron and Steel

The stoppage of the foundries for a few days at Easter has slightly eased the constant pressure for prompt supplies of pig-iron. Better still, the effectively publicised need of the blast furnaces for increased deliveries of coke appears to be receiving attention, and there is no doubt that if more fuel is placed at their disposal the rising trend of pig-iron production can be continued. The favourable factor is the easier trend of ore freights, which at present levels represents a substantial economy in blast furnace costs. Home ore production is also increasing.

Wire rods from Japan are now helping to solve the most acute problem confronting the wire drawers. And it is understood that some of the American ingots which have already been discharged in British ports will be rolled down into billets for the light and rolling mills. All these mills have an abundance of work on hand, but the heaviest pressure of all is for light sheets.

Comparison with overseas quotations still shows British steel prices in a favourable light. British makers have no reason to complain of any lack of inquiry, but the exportable surplus is distinctly limited. Deliveries of finished steel to the shipyards, engineering shops, motor works, etc., are all carefully controlled, and although allocations are well below the tonnages sought, most industrial establishments seem to be able to carry on without much difficulty.

Non-ferrous Metals

The revolution that has occurred in Bolivia has inevitably interfered with the resumption of talks between the tin producers there and the American Reconstruction Finance Corporation on the question of arranging a contract for a supply of Bolivian concentrates to the United States. It will be remembered that the discussions were broken off some weeks ago, when a deadlock was reached through the inability of the two sides to agree upon an acceptable price basis.

Since then the R.F.C. has bought a considerable tonnage through contractual arrangements with Indonesia and the Belgian Congo, quite apart from the big deal put through with the U.K. It would seem that the next move lies with the Bolivians, for the advent of a new government has obviously complicated the issue considerably.

In London trading on the Exchange is far from brisk, and the trend of values last week was rather lower. Actually business on Friday of last week was quite good, the turnover at the mid-day session being 225 tons. Only two warrants were traded in the afternoon.

London Metal Exchange official tin quotations were as follow:—

Cash—Thursday, £960 to £960 10s.; Friday, £961 10s. to £962 10s.; Monday, £961 to £962; Tuesday, £961 to £962.

Three Months—Thursday, £962 10s. to £963; Friday, £963 10s. to £964 10s.; Monday, £963 10s. to £964 10s.; Tuesday, £963 10s. to £964.

The American Copper Institute has published figures for the month of March, the details being in short tons. Production of crude copper was 86,840 tons, compared with 80,875 tons, while refined output also improved to 94,565 tons against 85,980 tons in February. Deliveries to domestic consumers rose from 104,795 tons in February to 112,625 tons in March, while stocks of refined copper fell from 59,745 tons at February 29 to 58,485 tons at the end of March. These figures certainly suggest a continuation of active conditions in the U.S. copper industry, and this is indeed the case, even though recent reports give the impression that the consumers' call for copper may not be quite as insistent as it was.

That the United States economy requires help from the Chilean mines cannot be doubted, and the recent threat of strike trouble at two of the properties was a disturbing factor. At the moment an argument is in progress as to the price at which Chilean copper is to be made available to the United States market during the ensuing 12 months, and it is not as yet certain how this will fall out. It looks as if some advance on 27½ cents must be conceded, but whether the U.S. Government will absorb this, or whether the f.a.s. quotation must be increased, is not yet clear.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

JOINT STANDING COMMITTEE ON CONDITIONS IN IRONFOUNDRIES SUB-COMMITTEE.

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—I have been asked by the above-mentioned Committee to seek your assistance in obtaining from the foundry industry any information that is available on successful methods in use to suppress or control dust at the following processes:—

(1) Hand brushing of castings.
(2) Mechanical knockout.
(3) Knockout in loose patternshops.
(4) Swing frame grinders.

In addition, the Committee is trying to ascertain the extent to which vacuum cleaning is applied in foundries and the degree of success obtained. Information is desired in respect of normal shop-cleaning work and also in respect of the substitution of vacuum methods for the use of compressed air or dry brushing in the cleaning of moulds. The Committee will welcome information on any of the matters mentioned above.

Yours, etc.,
W. B. LAWRIE, Secretary.

H.M. Inspector of Factories
(Engineering and Chemical Branch),
Artillery House, Artillery Row, London, S.W.1.

Presentation to Mr. F. F. McFadzean

The Joint Committee of Light Metal Trades unions were the guests of the National Union of General and Municipal Workers, at a function which took place in the Grand Hotel, Glasgow, on Friday, April 4. The function took the form of a luncheon, at which a cheque was presented on behalf of the Joint Committee to Mr. F. F. McFadzean to mark his recent retirement as secretary of the National Light Castings Ironfounders' Federation. The Joint Committee were fully represented, and in addition to Mr. McFadzean, Mr. H. V. Shelton, chairman, and Mr. I. A. Sutherland, secretary, of the Federation, were present as guests. In making the presentation, Mr. R. H. Ward, chairman of the Joint Committee, referred to the cordial relationships which existed in the Light Castings Industry between employers and employees. Replying in suitable terms, Mr. McFadzean referred to the progress which had been made over the years during which he had been associated with the Federation, and Mr. Shelton, on behalf of the Federation, expressed the hope that these relationships which had been patiently built up over the years would continue to prosper.